

# Informational Leaflet 149

## A SUMMARY OF PRELIMINARY 1971 FORECASTS FOR ALASKAN SALMON FISHERIES

Prepared by:

Division of Commercial Fisheries

Edited by:

Melvin C. Seibel, Senior Biometrician  
Division of Commercial Fisheries

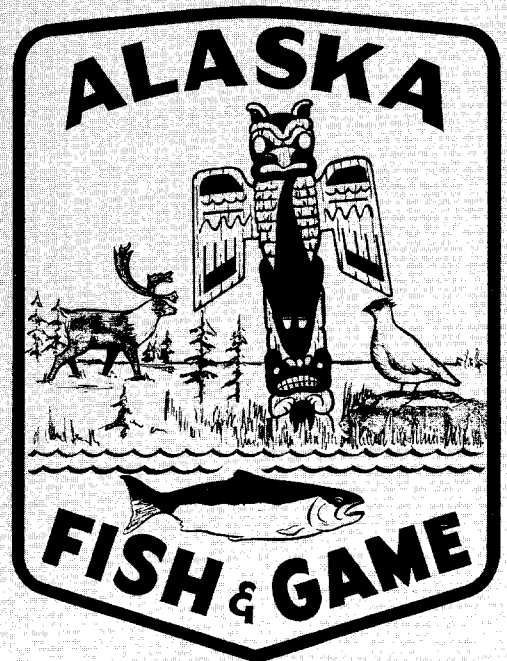
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## FOREWORD

The Alaska Department of Fish and Game presents the following forecast information in the hopes that it will prove of value to participants in Alaska's commercial salmon fisheries in 1971. We wish to emphasize the preliminary status of the forecast information presented as these forecasts are based in part on preliminary data collected during the 1970 season. Significant changes which may occur in the final forecasts will be made public via the news media and/or the final Department forecast publications.

A SUMMARY OF PRELIMINARY 1971 FORECASTS FOR  
ALASKAN SALMON FISHERIES

INTRODUCTION

This report is the second in a series of annual reports prepared by the Commercial Fisheries Division of the Alaska Department of Fish and Game to present preliminary forecasts of total returns to some major salmon fisheries in Alaska for the coming season. In addition to forecasts of total returns for some of the major fisheries, the projected commercial salmon harvest for the entire state in 1971 is also presented.

Salmon forecasting programs constitute an integral and important part of the Department's salmon management programs. These forecasts - representing the best available pre-season estimates of the size of returning salmon runs - provide the salmon industry, fisherman and processors, with information for operational planning and the Board of Fish and Game and the Department with information for the establishment of fishing regulations. For the Department's management biologists, these pre-season forecasts represent estimates of the returning runs to be used until information is obtained as the salmon runs actually arrive at the inshore fisheries, rivers and streams.

As stated above, forecasting is an important part of the Department's salmon management program. However, recently a tendency has developed to interpret accurate forecasting as the primary goal or objective. The publicity afforded pre-season forecasts has undoubtedly contributed to this tendency. It should be strongly emphasized that, although the Department desires to achieve maximum accuracy of its forecasts, the primary goal of commercial fisheries management is the achievement of maximum sustained yield (yield being defined in terms of pounds or numbers of fish). Achievement of this primary goal is dependent on the estimation and achievement of optimum spawning populations, which may be possible in spite of an inaccurate forecast. Because of the multitude of highly variable factors affecting survival of salmon from the time they are spawned until they return from the ocean rearing areas, and because the majority of these factors are neither controllable nor monitored, the actual return in a given year may deviate significantly from the forecasted return which is based on average survival conditions. However, extensive monitoring of a salmon run as it materializes in the inshore fisheries, rivers and streams may make it possible to develop a pattern of emergency regulations which will in fact result in the achievement of desired escapement

goals. In the event that the actual return is different from the forecast, the realized harvest will necessarily differ from the pre-season estimate of harvest.

The three regions used for the purpose of this report are the statistical regions by which commercial fisheries statistics are presented in the Department's Statistical Leaflet series and in prior statistical reports. The boundaries of these regions are shown in Figure 1 and are defined as follows:

- SOUTHEASTERN: Dixon Entrance to Cape Suckling (including the Southeastern Alaska and Yakutat areas).
- CENTRAL: Cape Suckling to Seal Cape on the southwestern tip of Unimak Island (including the Copper River-Bering Rivers, Prince William Sound, Cook Inlet, Kodiak, Chignik and South Side Alaska Peninsula areas).
- WESTERN: Seal Cape to, and including, the Aleutian Islands and the Bering Sea north through Kotzebue Sound. (Including the Aleutian Islands, North Side Alaska Peninsula, Bristol Bay, and Arctic-Yukon-Kuskokwim areas.)

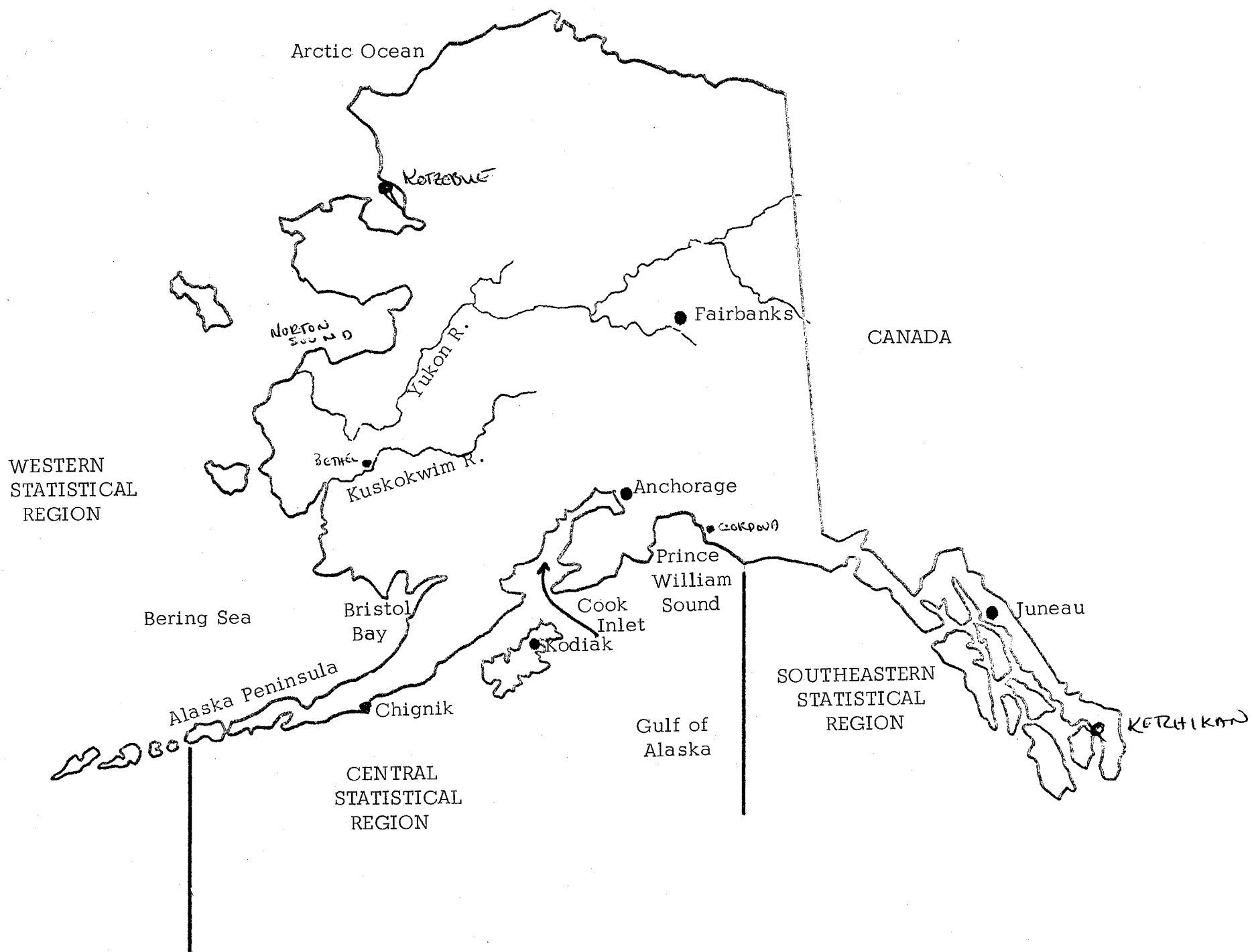
The use of these statistical regions for the presentation of salmon forecasts and harvest data facilitates the comparison of this data with past salmon harvest statistics.

For geographical descriptions of the areas and/or districts referred to in this report, the reader is referred to the 1969 Alaska Commercial Fishing Regulations.

To clarify the terminology used in this report, the following definitions are presented:

- 1) The terms "run," "return," "total run" or "total return" are used to designate the total number of salmon returning to Alaskan waters from the ocean rearing areas. A portion of this total number of salmon is normally harvested while the remaining fish are allowed to reach the spawning grounds.
- 2) The terms "catch" or "harvest" are used to designate those fish which are taken or harvested by commercial, sport or subsistence fisheries. In this report, catch or harvest generally refer to commercial catch or harvest.

FIGURE 1. ALASKA DEPARTMENT OF FISH AND GAME COMMERCIAL FISHERIES STATISTICAL REGIONS.



- 3) The terms "escapement," "spawners" or "brood stock" are used to designate those fish which have eluded the fisheries or have been protected by regulation and allowed to reach the spawning grounds.

#### IMPORTANT NOTE

It should be emphasized that the majority of the 1970 commercial catch data and the 1971 forecast information presented in this report is of a preliminary nature. The 1970 commercial catch information is based on preliminary cannery reports and/or preliminary compilation of fish tickets. Final compilation of 1970 commercial catch data will be completed in 1971. Forecast information presented here for the 1971 season is also preliminary as much of the biological data collected during the 1970 season is only now being compiled and summarized into a form in which it can be incorporated in the final forecast analysis. Final 1971 forecasts will be published by the Department in the spring of 1971.

The following Department biologists contributed the forecast materials presented in the following sections:

Southeastern Alaska: Lou Gwartney, Charles Larson, Kenneth Durley,  
Gerry Downey

Prince William Sound: Robert Roys, David Solf, Peter Fridgen, Ralph Pirtle

Cook Inlet: Allen Davis, Donald Stewart, Paul Kissner

Kodiak: Larry Edfelt, Kenneth Manthey

Chignik: Paul Pedersen

Bristol Bay: Robert Paulus, Michael McCurdy, Steve Pennoyer, Michael  
Nelson

Arctic-Yukon-Kuskokwim: Ronald Regnart

## BRIEF REVIEW OF THE 1970 ALASKAN SALMON SEASON

Although the 1970 commercial salmon harvest of approximately 66 million fish fell short of the 96 million harvest level projected by the Department (Noerenberg and Seibel (Eds.), 1969) in the fall of 1969, it still represents the largest harvest achieved in more than twenty years. During the 1950's, the largest annual harvest totaled 49.5 million in 1951 while the largest harvest of the 1960's was the 65.7 million in 1964. The 1970 harvest of 66.1 million represents a 29 percent increase over the 1960-69 average harvest level of 51 million. For further comparisons, the preliminary 1970 commercial salmon harvests by major fishing areas and species are presented in Table 1 and commercial salmon harvests for the years 1950-70 are presented in Appendix A.

Referring to Table 1, pink salmon harvests in the Southeastern Alaska and Kodiak areas and the sockeye harvest in Bristol Bay accounted for approximately two thirds of the total state harvest. In spite of very excellent harvests achieved in these areas in 1970, in each of the three areas harvests fell short of pre-season predictions.

In Southeastern Alaska a pre-season estimated harvest of 18.7 million pink salmon was only partly achieved as the 1970 pink salmon harvest totaled approximately 10 million. The greatest weakness occurred in the Southern Southeastern district where a total pink salmon return of 9.9 million was observed in contrast to a forecasted total return for that district of 18.7 million.

Analysis of pre-emergent fry data collected in the Kodiak area resulted in a pre-season total return forecast of 17.7-23.5 million pink salmon for the 1970 season. As stated in the final Kodiak forecast report (Edfelt, 1970), forecasting of the 1970 Kodiak pink salmon run was dependent on estimating returns from fry densities larger than previously observed and consequently greater than average error might be expected. This in fact occurred as the observed pink salmon run in 1970 totaled 14.8 million, slightly below the lower range of the forecast. Correspondingly, the actual harvest of approximately 12 million pink salmon was 4.6 million below the projected 16.6 million harvest.

In preparation of the 1970 Bristol Bay sockeye forecast, the same problem was encountered as in the Kodiak pink salmon forecast. Only very limited information was available regarding potential production from an escapement as large as the 1965 escapement of 24.6 million sockeye to the Kvichak system which was expected to provide the major contribution to the



TABLE 1. PRELIMINARY 1970 ALASKA COMMERCIAL SALMON HARVEST BY  
SPECIES AND MAJOR FISHING AREAS

Number of Fish in Thousands

Area	Species					Total
	King	Red	Coho	Pink	Chum	
Southeastern Alaska Region including Yakutat	266	624	489	9,962	1,616	12,957
Prince William Sound	20	1,243	242	2,752	223	4,480
Cook Inlet	8	750	277	1,352	999	3,386
Kodiak	1	916	65	12,018	916	13,916
Chignik	1	1,328	15	1,288	465	3,097
Alaska Peninsula - S. Side	2	1,793	33	1,727	982	4,537
Central Region Subtotal	32	6,030	632	19,137	3,585	29,416
Alaska Peninsula - N. Side and Aleutian Islands	3	214	26	681	53	977
Bristol Bay	152	20,589	13	328	685	21,767
Arctic-Yukon-Kuskokwim	147	13	78	92	673	1,003
Western Region Subtotal	302	20,816	117	1,101	1,411	23,747
Total Alaska	600	27,470	1,238	30,200	6,612	66,120

1970 Bristol Bay sockeye run. In contrast to the forecasted 1970 sockeye return of 44 million to the Kvichak system, an estimated 30 million fish were observed returning. The difference between the forecasted and actual returns to this single system accounted for nearly the entire difference between the forecasted return of 56 million for the total Bristol Bay complex and the observed return of 40 million sockeye. The pre-season projected sockeye harvest of 34 million was, consequently, only partly realized as a commercial harvest of 21 million sockeye was achieved.

In each of the above areas, reduced harvest levels were required to insure achievement of adequate escapements from the smaller than forecasted returns. The necessary reductions in harvest levels for the above three fisheries accounted for roughly 90 percent of the difference - on a statewide basis - between the pre-season projected level of harvest and the harvest actually achieved.

Table 2 presents a comparison of forecasted total returns and actual returns for the seven major areas and species for which forecasts of total salmon returns were available for the 1970 season. With the exception of the Chignik sockeye return, the 1970 returns for these areas - and for the species forecasted - were less than anticipated in pre-season forecasts. This suggests the possibility of above average mortalities affecting these salmon populations at some stage in the life cycle prior to returning as mature fish to Alaskan waters. However, substantial variations between past pre-season forecasts and actual returns and the absence of extensive information regarding mortality producing factors, precludes determining the specific causes of these forecast errors at this time.

Preliminary information provided by the Department's Statistics Section indicates the following salmon case pack production from Alaskan fisheries in 1970:

	Species					Total
	King	Red	Coho	Pink	Chum	
Thousands of 48-lb. cases	27	1,794	56	1,327	472	3,676

Complete information is not available regarding production of fresh, frozen and cured salmon products.

TABLE 2. A COMPARISON OF 1970 SALMON FORECASTS AND PRELIMINARY RETURNS TO SEVEN MAJOR SALMON FISHERIES IN ALASKA<sup>1/</sup>

Number of Fish in Thousands

Area	Species	Pre-season Forecast	Preliminary Return	Difference <sup>2/</sup>
Southeastern Alaska				
Northern Southeastern	Pink	9,000	6,440	- 2,560
Southern Southeastern	Pink	18,700	9,900	- 8,800
Prince William Sound				
	Pink	3,200 - 5,600	3,704	- 696
	Chum	347	324	- 23
Cook Inlet (Southern and Outer Districts only)	Pink	2,000	650	- 1,350
Kodiak	Pink	17,700-23,500	14,800	- 5,800
Chignik	Sockeye	1,134	2,510	+ 1,376
Bristol Bay	Sockeye	55,812	39,645	-16,167

<sup>1/</sup> At present, sufficient information is available for forecasting total salmon returns only for those species and areas listed above.

<sup>2/</sup> When a forecast range is presented, the midpoint of the range is used to determine forecast error.

PRELIMINARY FORECASTS OF TOTAL SALMON RETURNS TO SOME  
MAJOR ALASKAN FISHERIES IN 1971

The Department's salmon management program includes a number of projects designed to provide pre-season forecasts of annual salmon runs. The areas and species on which forecast research is presently being conducted were chosen on priority basis relative to economic importance, potential predictability of annual returns and compatibility with existing programs.

Each forecast project is designed to obtain a measure of salmon abundance at one or more of the following stages in the salmon's life cycle - parent spawning (an indirect measure of the population to be predicted), pre-emergent fry or alevin stage or during smolt outmigration. Comparison of these measures of abundance with the actual number of mature salmon returning provides a basis for forecasting future returns.

Table 3 presents preliminary 1971 salmon forecasts for those areas and species for which forecasts of total returns are available. In 1970 these combined fisheries contributed approximately 70 percent of the total number of salmon harvested in Alaska. In years of smaller salmon returns, the proportionate contribution of these fisheries would be expected to be less.

Comparing the preliminary 1971 forecasts for these fisheries with the preliminary 1970 returns shown in Table 2 indicates that, with the exception of the Prince William Sound pink and chum salmon fisheries, 1971 returns to these major fisheries are expected to be smaller than the runs experienced in 1970. This is due primarily to recent weaknesses in odd-year pink salmon runs and for Bristol Bay, the occurrence of a non-peak year for the major Kvichak River system.

In terms of anticipated commercial harvest for 1971, the effect of smaller returns will be especially significant in Southern Southeastern Alaska where a return of the magnitude forecasted, viz. 4.3 million will preclude a commercial harvest of any significance. Comparison of the anticipated total commercial salmon harvest for Alaska for 1971 with commercial harvests of recent years will be presented in the following section.

Additional information on forecast techniques, anticipated harvests, relative strength of district returns, etc. for these major fisheries is provided in the area forecasts presented in Appendix B.

TABLE 3. PRELIMINARY FORECASTS OF TOTAL SALMON RETURNS TO SOME <sup>1/</sup>  
MAJOR ALASKAN FISHERIES IN 1971.

Number of Fish in Thousands

Area	Species	Forecasted Total Return	Estimated Harvest <sup>2/</sup>
Southern Southeastern	Pink	4,300	0
Northern Southeastern	Pink	<u>8,500</u>	<u>5,000</u>
Southeastern Subtotal	Pink	12,800	5,000
Prince William Sound	Pink	6,200	4,700
	Chum	760	560
Cook Inlet - Outer and Southern District Only	Pink	480	280
Kodiak	Pink	8,300	7,000
Chignik	Sockeye	1,700	1,090
Bristol Bay	Sockeye	<u>16,900</u>	<u>9,480</u>
Totals <sup>3/</sup>		41,140	28,110

<sup>1/</sup> Forecasts of total salmon returns are available only for those areas and species listed above.

<sup>2/</sup> It should be emphasized that the estimated harvests presented here are based on an actual return of the magnitude forecasted. A return smaller than forecasted will require additional restrictions of fishing time to achieve desired escapement goals. Returns larger than forecasted will require relaxation of regulations to allow maximum harvest.

<sup>3/</sup> These totals are only for the areas and species listed. They do not include all species and all areas of Alaska.

PROJECTED TOTAL COMMERCIAL SALMON HARVEST FOR  
ALASKAN FISHERIES IN 1971

Pre-season forecasts of salmon runs and anticipated harvests for specific fisheries are essential to operational planning for persons directly involved with a specific fishery. However, pre-season information on the projected total Alaskan salmon production is also important for agencies, industries or persons involved in all fisheries such as industry suppliers, the transportation industry, the State government (for projection of state revenues) and others. Consequently, the Department is attempting to develop a basis for providing accurate pre-season estimates of total salmon production.

For those fisheries for which forecasts of total salmon returns are not available from forecast research studies, it is necessary to base pre-season projected levels of harvest on recent harvest trends exhibited by those fisheries. Estimates based on the latter method will generally reflect more variation from actual harvests as no adjustment is made for brood stock abundance which is a primary factor in determining future salmon stock abundance. However, the fact that the major fisheries for which forecasts - based on estimates of pre-adult stock abundance - of total return are available contribute a major portion of the total salmon production combined with the fact that many of the smaller fisheries tend to reflect less year-to-year variation in harvest levels because of relatively low fishing efforts should allow reasonably accurate pre-season projections of total salmon production.

The projected commercial salmon harvest for Alaskan fisheries in 1971 is presented by species and statistical region in Table 4. The estimated total harvest of 41.5 million fish is composed primarily (85%) of red and pink salmon, the major commercial salmon species in Alaska. Primary contributors to the commercial harvest of these species will be the Bristol Bay sockeye fishery and the Kodiak, Southeastern and Prince William Sound pink salmon fisheries.

Based on the relationship between recent annual commercial salmon harvests expressed in numbers of fish and the corresponding case packs, it is estimated that a 1971 harvest of 41.5 million fish will result in a case pack equivalent to 2.3 million 48-lb. cases. (Cases other than 48-lb. cases are converted to an equivalent number of standard 48-lb. cases for comparison purposes.) This estimate of canned salmon production does not include production of fresh, frozen or cured products which constitute approximately 20 percent by weight of total salmon products. Production of fresh,

TABLE 4. PROJECTED TOTAL COMMERCIAL SALMON HARVESTS BY ALASKAN FISHERIES IN 1971 <sup>1/</sup>

Number of Fish in Thousands						
Statistical Region	Species					Total
	King	Red	Coho	Pink	Chum	
Southeastern	500	800	750	5,000	1,000	7,850
Central	20	3,960	410	15,000	2,300	21,690
Western	280	9,740	200	670	1,030	11,920
Total Alaska	600	14,500	1,360	20,670	4,330	41,460
XX						
Estimated number of 48-lb. cases in thousands <sup>2/</sup>	30	1,000	30	980	270	2,310

<sup>1/</sup> The above estimates of 1971 salmon harvests were obtained by combining estimates of commercial harvests resulting from the forecasts of total returns to some of the major salmon fisheries (refer to Table 3) with projected harvests of the remaining fisheries based on recent harvest trends.

<sup>2/</sup> Although the majority of salmon harvested commercially in Alaska are processed as canned products, a large proportion of the harvest of certain species, in particular king and coho salmon, is processed as fresh/frozen and cured products. The number of cases presented above are not adjusted to include salmon processed by means other than canning, consequently the fish per case ratio indicated in this table may not agree with the actual cannery conversion rate of fish per case. Cases other than 48-lb. cases are converted to an equivalent number of standard 48-lb. cases.

frozen or cured salmon products in 1971 is expected to be between 15 and 20 million pounds.

The projected 1971 salmon harvest of 41.5 million fish is 20 percent below the 1960-69 average of 51 million and approximately equals the average 1950-59 harvest of 41 million salmon. The anticipated 1971 harvest level would correspond closely to the recent 1969 harvest of 41.9 million salmon.

## SUMMARY

Although the projected 1971 salmon harvest falls below the 1960-69 average annual harvest, the Department remains optimistic in regards to future production of Alaska's salmon fisheries. Some factors responsible for this optimism are (1) the encouraging rate of recovery of important salmon producing areas in Prince William Sound seriously damaged by the 1964 earthquake, (2) achievement in 1969 and 1970 of two consecutive good escapements for the Kvichak River - major sockeye system in Bristol Bay - reflecting the Department's strategy to return this fishery to a healthier pattern of two or three good years per five-year cycle rather than the present single large year per cycle, (3) increasing trends in recent odd-year pink salmon runs in the Southeastern and Kodiak fisheries and (4) generally, the continued accumulation of scientific data necessary for estimation and achievement of escapements required for achievement of maximum sustained yield.

In contrast to the above factors which should contribute to the future health of Alaska's salmon stocks, a number of potentially detrimental factors also exist. Future development and increased utilization of Alaska's other natural resources can, unless carefully planned, result in damage to and destruction of salmon spawning and rearing areas. Alaska is in the unique position of having available the vast knowledge and experience gained by the other states in the management of their resources; use of this knowledge can result in the development of sound conservation programs designed to optimize the return from all of Alaska's resources. Other problem areas are (1) increased activity of foreign fishing fleets in ocean waters where Alaskan salmon rear or migrate and (2) increased participation in Alaska's fisheries with the subsequent reduction in economic return per participant. The latter problem cannot be solved by returning Alaska's salmon populations to their previous high levels of abundance if, correspondingly, the participation continues to increase.

In summary, the Department wishes to emphasize that the estimates of salmon harvests for 1971 presented above are dependent on 1971 salmon



returns being of the magnitudes anticipated. Returns weaker than forecasted may require additional restriction of harvests to insure desired escapement goals while returns larger than forecasted may result in relaxation of regulations to insure maximum allowable harvest.

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Note: The following publications (although not referenced in this report) presented final 1970 salmon forecasts for specific areas: Informational Leaflet Nos. 142, 143, 144 and 146.

APPENDIX A. ANNUAL ALASKA COMMERCIAL SALMON HARVEST BY  
SPECIES AND STATISTICAL REGION, 1950-1970

APPENDIX TABLE A-1. ANNUAL ALASKA COMMERCIAL SALMON HARVEST BY SPECIES AND STATISTICAL REGION, 1950-1970.

Number of Fish in Thousands

Year	Statistical Region <sup>1/</sup>	Species					Total	No. of 48-lb. Cases in Thousands <sup>2/</sup>
		King	Red	Coho	Pink	Chum		
1950	SOUTHEASTERN	379	552	1,652	9,424	4,779	16,786	1,199
	CENTRAL	137	5,947	762	11,978	2,515	21,339	1,465
	WESTERN	95	7,267	83	30	447	7,922	644
	Subtotal	611	13,766	2,497	21,432	7,741	46,047	3,308
1951	SOUTHEASTERN	474	820	3,310	22,211	4,123	30,938	2,028
	CENTRAL	213	4,136	645	6,185	2,040	13,219	1,068
	WESTERN	102	4,697	76	21	454	5,350	389
	Subtotal	789	9,653	4,031	28,417	6,617	49,507	3,485
1952	SOUTHEASTERN	528	919	1,746	9,819	4,179	17,191	1,321
	CENTRAL	115	4,341	617	10,012	3,463	18,548	1,456
	WESTERN	92	11,664	70	47	522	12,395	797
	Subtotal	735	16,924	2,433	19,878	8,164	48,134	3,574
1953	SOUTHEASTERN	498	1,376	1,164	4,980	3,542	11,560	978
	CENTRAL	112	3,763	387	10,602	3,132	17,996	1,351
	WESTERN	102	6,654	31	88	619	7,494	534
	Subtotal	712	11,793	1,582	15,670	7,293	37,050	2,863
1954	SOUTHEASTERN	398	1,208	1,771	8,909	4,242	16,528	1,303
	CENTRAL	85	3,190	679	12,576	3,323	19,853	1,395
	WESTERN	128	5,014	59	688	820	6,709	397
	Subtotal	611	9,412	2,509	22,173	8,385	43,090	3,095
1955	SOUTHEASTERN	372	681	1,338	9,334	1,527	13,252	840
	CENTRAL	74	2,675	468	14,758	1,631	19,606	1,163
	WESTERN	135	5,148	27	32	342	5,684	383
	Subtotal	581	8,504	1,833	24,124	3,500	38,542	2,386
1956	SOUTHEASTERN	239	921	935	13,472	2,736	18,303	1,032
	CENTRAL	82	3,432	495	11,940	3,674	19,623	1,349
	WESTERN	137	10,252	52	125	791	11,357	641
	Subtotal	458	14,605	1,482	25,537	7,201	49,283	3,022

APPENDIX TABLE A-1. ANNUAL ALASKA COMMERCIAL SALMON HARVEST BY SPECIES AND STATISTICAL REGION, 1950-1970 (cont.).

Number of Fish in Thousands

Year	Statistical Region <sup>1/</sup>	Species					Total	No. of 48-lb. Cases in Thousands <sup>2/</sup>
		King	Red	Coho	Pink	Chum		
1957	SOUTHEASTERN	298	1,031	1,217	6,858	3,369	12,773	905
	CENTRAL	57	2,071	301	6,659	4,362	13,450	1,002
	WESTERN	158	6,631	87	4	548	7,428	557
	Subtotal	513	9,733	1,605	13,521	8,279	33,651	2,464
1958	SOUTHEASTERN	323	971	955	9,836	2,767	14,852	1,181
	CENTRAL	45	1,636	459	14,452	3,244	19,836	1,354
	WESTERN	182	3,460	193	1,809	613	6,257	437
	Subtotal	550	6,067	1,607	26,097	6,624	40,945	2,972
1959	SOUTHEASTERN	359	777	1,094	7,851	1,247	11,328	759
	CENTRAL	47	1,937	332	3,057	1,908	7,281	573
	WESTERN	195	5,249	76	22	886	6,428	446
	Subtotal	601	7,963	1,502	10,930	4,041	25,037	1,778
1960	SOUTHEASTERN	310	588	721	2,985	1,019	5,623	318
	CENTRAL	41	2,835	618	12,313	3,682	19,489	1,205
	WESTERN	196	14,411	66	782	1,923	17,378	1,049
	Subtotal	547	17,834	1,405	16,080	6,624	42,490	2,572
1961	SOUTHEASTERN	230	744	889	12,638	2,559	17,060	1,224
	CENTRAL	31	3,030	357	8,736	2,080	14,234	940
	WESTERN	243	12,307	67	132	991	13,740	1,048
	Subtotal	504	16,081	1,313	21,506	5,630	45,034	3,212
1962	SOUTHEASTERN	206	772	1,223	11,585	1,996	15,782	935
	CENTRAL	42	3,534	692	29,297	4,024	37,589	2,013
	WESTERN	213	4,990	124	2,981	1,128	9,436	528
	Subtotal	461	9,296	2,039	43,863	7,148	62,807	3,476
1963	SOUTHEASTERN	258	678	1,275	19,145	1,479	22,835	1,216
	CENTRAL	35	2,437	627	14,976	2,350	20,425	1,135
	WESTERN	208	3,101	121	154	635	4,219	305
	Subtotal	501	6,216	2,023	34,275	4,464	47,479	2,656

APPENDIX TABLE A-1. ANNUAL ALASKA COMMERCIAL SALMON HARVEST BY SPECIES AND STATISTICAL REGION, 1950-1970 (cont.).

Number of Fish in Thousands

Year	Statistical Region <sup>1/</sup>	Species					Total	No. of 48-lb. Cases in Thousands <sup>2/</sup>
		King	Red	Coho	Pink	Chum		
1964	SOUTHEASTERN	357	924	1,588	18,581	1,936	23,386	1,263
	CENTRAL	22	3,198	866	24,945	4,160	33,191	1,724
	WESTERN	260	5,839	105	1,747	1,179	9,130	563
	Subtotal	639	9,961	2,559	45,273	7,275	65,707	3,550
1965	SOUTHEASTERN	287	1,085	1,548	10,880	1,474	15,274	758
	CENTRAL	31	4,229	393	9,464	1,635	15,752	985
	WESTERN	265	24,732	57	3	271	25,328	1,525
	Subtotal	583	30,046	1,998	20,347	3,380	56,354	3,268
1966	SOUTHEASTERN	308	1,054	1,227	20,438	3,273	26,300	1,562
	CENTRAL	24	4,458	574	17,028	2,574	24,658	1,532
	WESTERN	208	9,562	119	2,585	609	13,083	897
	Subtotal	540	15,074	1,920	40,051	6,456	64,041	3,991
1967	SOUTHEASTERN	301	972	866	3,111	1,810	7,060	431
	CENTRAL	26	3,049	450	3,409	1,198	8,132	609
	WESTERN	284	4,557	172	39	646	5,698	424
	Subtotal	611	8,578	1,488	6,559	3,654	20,890	1,464
1968	SOUTHEASTERN	332	831	1,543	25,085	2,644	30,435	1,372
	CENTRAL	20	4,260	875	16,664	2,837	24,656	1,437
	WESTERN	259	3,039	333	2,977	601	7,209	359
	Subtotal	611	8,130	2,751	44,726	6,082	62,300	3,168
1969 <sup>3/</sup>	SOUTHEASTERN	313	810	594	4,859	561	7,137	308
	CENTRAL	36	3,662	259	20,552	1,627	26,136	1,447
	WESTERN	287	6,931	263	332	770	8,583	497
	Subtotal	636	11,403	1,116	25,743	2,958	41,856	2,252
1970 <sup>3/</sup>	SOUTHEASTERN	266	624	489	9,962	1,616	12,957	683
	CENTRAL	32	6,030	632	19,137	3,585	29,416	1,736
	WESTERN	302	20,816	117	1,101	1,411	23,747	1,257
	Subtotal	600	27,470	1,238	30,200	6,612	66,120	3,676

APPENDIX TABLE A-1. ANNUAL ALASKA COMMERCIAL SALMON HARVEST BY SPECIES AND STATISTICAL REGION, 1950-1970 (cont.).

Data Sources:   i)     Alaska Department of Fish and Game  
                              Statistical Leaflet No. 15

                  ii)     Alaska Department of Fish and Game  
                              Statistics Section. Unpublished data.

                  iii)    Alaska Fisheries Reports, 1954-59. Bureau of  
                              Commercial Fisheries, U. S. Fish and Wildlife  
                              Service.

1/ For the purpose of reporting Alaska commercial fisheries statistics, the statistical regions are defined as follows:

SOUTHEASTERN:     Dixon Entrance to Cape Suckling

CENTRAL:           Cape Suckling to Seal Cape on the southwestern  
                              tip of Unimak Island

WESTERN:           Seal Cape to, and including, the Aleutian Islands  
                              and the Bering Cape north through Kotzebue Sound.

2/ Although the majority of commercially harvested salmon in Alaska are processed as canned products, in some regions certain species (such as king and coho salmon in the Southeastern region) are processed predominantly as fresh/frozen or cured products. These case pack figures do not include salmon processed in ways other than canning.

3/ Preliminary data

APPENDIX B. PRESENTATION OF PRELIMINARY FORECASTS,  
FORECAST TECHNIQUES AND DISCUSSION OF ANTICIPATED 1971  
SEASONS FOR SOME MAJOR ALASKAN SALMON FISHERIES FOR  
WHICH FORECASTS OF TOTAL RETURNS ARE AVAILABLE.



FORECAST AREA: Chignik

SPECIES: Sockeye Salmon

PRELIMINARY FORECAST OF 1971 TOTAL RETURN:

Point Estimate = 1.7 million

FORECAST METHODS:

Early Run (Black Lake)

The early red salmon forecast is based on the relationship between the return of .2 ocean fish one year and the return of .3 ocean fish the following year. The 1970 return of .2 ocean fish was approximately 136,000. On the basis of the regression of .3 ocean fish on .2 ocean fish, a return of about 1,238,000 .3 ocean fish would be expected in 1971. The number of .2 ocean fish in a given year has been approximately 10% of the return of .3 ocean fish the following year. Based on a spawner-return of 1:3, the 1972 return would be near 984,000. Ten percent of this would give an additional 98,000 .2 ocean fish in 1971 for a total possible early return of 1,336,000.

A spawner-return ratio of approximately 1:3 has existed in the early run since 1958. With an escapement of 383,000 in 1966, based on a predominant five-year cycle, the 1971 return would be about 1,150,000. This figure, although not based on individual year classes but only assuming a five-year cycle, does help support the figure obtained in the regression analysis of .3 ocean fish on .2 ocean fish.

Late Run (Chignik Lake)

Red salmon which have reared for two years in the ocean generally constitute approximately ten percent of the total red salmon returns to the Chignik Lake system. The prediction for the 1971 .2 ocean fish return to the Chignik Lake system will be based on the application of an average maturity schedule to total returns from brood years estimated from the same spawner-recruit curve used in the 1970 forecast.

The spawner-recruit curve was drawn to the escapement-return data for the years 1950-1963. On the basis of this curve, the total returns from the brood years 1967 and 1966 are estimated to be

approximately 460,000 and 450,000 red salmon respectively. The 1.2 and 2.2 salmon returning in 1971 will be the progeny of the 1967 and 1966 brood year escapements. Adult returns from the brood years 1950-1963 has consisted of, on the average, 2.2 percent 1.2 fish and 7.1 percent 2.2 fish. Therefore, the expected return of 1.2 fish in 1971 is approximately 10,000 while approximately 32,000 2.2 fish would be expected.

The two estimates obtained above yield a predicted 1971 .2 ocean return of approximately 42,000 fish.

The prediction of the .3 ocean fish return to the Chignik Lake system in 1971 is obtained by estimating separately the returns of 1.3 and 2.3 fish. Again, the basic method employed is the application of an average maturity schedule to total returns from brood years estimated on the basis of the fitted spawner-recruit curve used in the 1970 forecast.

Adult returns from the brood years 1950-1963 have consisted of, on the average, approximately 28 percent 1. freshwater fish. Of the total return of 450,000 fish expected from the 1966 brood year, 28 percent or 126,000 should be 1. freshwater fish. An estimated 10,000 1.2 fish were forecast to return to the Chignik Lake system in 1970, leaving an estimated 116,000 1.3 fish to return in 1971.

The 2.3 fish returning in 1971 will be the progeny of the 1965 brood year. On the basis of the fitted spawner-recruit curve, an estimated 431,000 fish are expected from the 1965 brood year escapement. To date, 92,000 1.2 fish in 1969 and a predicted 31,000 2.2 and 96,000 1.3 fish in 1970 have supposedly returned from the 1965 brood year. This leaves an estimated 212,000 2.3 fish expected to return in 1971 to the Chignik system.

The estimates of 116,000 1.3 fish and 212,000 2.3 fish yield a total estimated .3 ocean return of 328,000 fish in 1971.

Combining the .2 ocean prediction of 42,000 and the .3 ocean prediction of 328,000 yields a total Chignik Lake or late run forecast of 370,000 red salmon for 1971. This forecast is approximately 180,000 fish less than the 1950-1970 average return of approximately 550,000 fish.

#### DISCUSSION OF 1971 FORECAST:

The optimum escapement into the early system has been estimated

at approximately 400,000 red salmon. With a predicted return of 1,336,000 fish, a possible commercial harvest of 936,000 can be anticipated prior to July 1.

The late system should receive an estimated 200-250,000 in escapement. With a forecast of only 370,000 fish, the possible harvest of this portion of the run would be near 150,000.

Prepared by: Paul Pedersen  
Chignik Area Management Biologist  
Division of Commercial Fisheries  
Kodiak

FORECAST AREA: Bristol Bay

SPECIES: Sockeye Salmon

PRELIMINARY FORECAST OF 1971 TOTAL RETURN:

Point Estimate = 16.9 million

FORECAST METHODS:

Most Bristol Bay sockeye salmon mature after four, five or six years. The forecasted run for 1971 will, therefore, be progeny of the spawning escapements of 1965, 1966 and 1967. The first of these, 1965, was the Kvichak River peak year which produced the large run in 1970. Forecasts of Bristol Bay sockeye salmon returns are based generally on one or more of the following three methods:

- (1) Escapement-return relationships, based on past data, provide estimates of total return by system from parent year escapements. Returns to the Kvichak River, because of the distinct difference between peak and non-peak year escapement magnitudes, are forecasted from two sets of relationships, one for peak years, and another for non-peak years. Average age structures of past returns are applied to the total estimated return, and those fish expected in the forecasted year are added by system for a total forecasted return.
- (2) On several systems, programs are operated to evaluate production of the outmigrating fingerlings, called smolt, from each escapement. In some cases total outmigration estimates are made, while in others relative annual abundance of smolt is measured.

Past marine survival by smolt age class is applied to the smolt index of abundance to obtain an estimate of returning adults. Past ocean age structures are applied to the smolt-adult relationship estimates for forecasting numbers by age returning in a forecasted year.

- (3) For all systems relationships have been developed between fish returning at a specific age in one year and fish from the same brood year of the same freshwater age returning in the following year. In cases where the relationship is reliable, the technique may be applied.

In any system modifications or combinations of the above may be applied. The choice of methods used depends on which data are available, and the tested or apparent consistency of each technique for the age class and system being forecasted.

#### DISCUSSION OF 1971 FORECAST:

The 1971 forecast is for a total inshore run of 16.9 million of which 50 percent is attributed to Kvichak River production. This preliminary forecast indicates that most of the fish should be large six-year-olds from the 1965 escapement.

Of the forecasted inshore return of 16.9 million fish, approximately 6.4 million fish are required for escapement. The estimated catch by system should be, in millions of sockeye:

Naknek-Kvichak	6.032
Egegik	1.480
Ugashik	.529
Nushagak-Igushik	1.233
Togiak	<u>.202</u>
Total Bristol Bay	9.476

Prepared by: Robert Paulus  
Research Project Leader  
Division of Commercial Fisheries  
Anchorage

Contributing biologists: M. McCurdy  
S. Pennoyer

FORECAST AREA: Kodiak

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1971 TOTAL RETURN:

Point Estimate = 8.3 million

Range Estimate = 7.4 - 8.6 million

FORECAST METHODS:

Forecasts of total pink salmon returns to the Kodiak area are based on the abundance of pre-emergent fry observed during the spring sampling period. Hydraulic sampling of 23 major pink salmon producing streams yielded an above-average density for the odd-year cycle. A ratio of the parent year pre-emergent fry density to the 1971 index for 21 comparable streams indicates the 1971 return at 8.3 million pink salmon.

Forecast by District

The relative strengths of expected returns to five major districts of the Kodiak-Afognak area are indicated below:

- 1) Afognak-Kizhuyak - The generally poor densities obtained in this area indicate a return of 500,000 pinks in 1971, or about the same as the parent year.
- 2) Westside - The fry densities obtained in this area were generally below that of the parent year. Large reductions occurred in Bauman's Creek and Uganik River. Uyak River should be the primary producer in this area for which the forecast is 700,000 pink salmon.
- 3) Karluk-Red River - This area does not produce pink salmon on the odd-year cycle. Only a few incidental pinks will be taken in the red salmon fishery.
- 4) Alitak - Fry densities were below the parent year densities in all streams sampled in the Alitak area. Deadman Bay should be the primary producer. A 1.9 million return is expected.
- 5) Eastside-Chiniak - This area from Monashka Bay to Cape Trinity, should produce 5.2 million pinks in 1971 and thus

constitute the bulk of the fishery.

### Discussion

Forecasts by district have, at times, been subject to error because they assume a projected pattern of catch similar to that of the parent year. Since the commercial effort varies with the timing and migration routes of the run, weather and regulations, fish destined for a particular district are often caught in neighboring districts. With these reservations in mind and if the 1971 return corresponds closely to the forecasted level of 8.3 million an estimated 7 million pink salmon could be harvested.

Prepared by: Larry Edfelt, Fishery Biologist  
Division of Commercial Fisheries  
Kodiak

Contributing biologist: K. Manthey

FORECAST AREA: Cook Inlet - Southern and Outer Districts Only

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1971 TOTAL RETURN:

Forecast based on alevin densities .....	640,000
Forecast based on parent year escapement .....	<u>320,000</u>
Average .....	480,000

FORECAST METHODS:

The 1971 forecast was derived from two methods: alevin density/return and escapement/return. Each method will be discussed separately.

- 1) Alevin density/return relationship: Indices of alevin abundance from nine important spawning streams in the Southern and Outer Districts is determined in the spring prior to emergence. The densities from each stream are weighted by average escapement and the resultant indices combined to arrive at a weighted alevin index for the two districts as a whole. This index is correlated with subsequent return and the regression line computed.
- 2) Escapement/return relationship: Escapements into index spawning streams are determined by foot surveys conducted throughout the spawning period. When sufficient surveys are collected to plot the spawning population increase and decline on any one stream then the total spawning population for the year is computed by measuring the area under the graph and dividing the result by the average number of days required to spawn. When insufficient data is collected concerning daily spawning populations, then the peak count for the season is used for the total escapement to the stream. Index stream spawning populations are added together to derive total yearly escapement for the Southern and Outer Districts. The total yearly escapement figure is correlated with subsequent return and the regression line computed.

DISCUSSION OF 1971 FORECAST:

Predictions of returning pink salmon to the Southern and Outer Districts of Cook Inlet have been published for the previous six years. Prior to 1969 the predictions had been relatively accurate, however the 1969 and 1970 forecast were both considerably higher than the



actual return. All published forecasts to date have been derived from the relationship between alevin density and subsequent return. Sampling methods have remained similar throughout the program.

A change in potential spawning area was caused by land subsidence during the March 1964 earthquake. Some portion of each stream's intertidal zone is now covered with salt water for a longer period of time, thereby removing the covered gravel beds from salmon production. Pre-emergent sampling and return data collected prior to the earthquake has been dropped from the analysis in an attempt to compare individual spawning streams on a yearly basis which are similar in nature.

The relationship between parent escapement and return for the Southern and Outer Districts has a better  $r^2$  value - indicating a better basis for forecasting - than the relationship between alevin density and return for the 1964-70 data. Using the escapement-return relationship, the escapement of 115,000 pinks in 1969 indicates a 1971 return of 320,000 while the alevin densities observed in the spring of 1970 indicates a 1971 return of 640,000. Averaging these two estimates yields an estimated 1971 return of 480,000, however, the two estimates producing this average should be considered as a potential range of return for the 1971 season.

Approximately 200,000 pinks are needed for spawning purposes if all streams are to receive adequate escapements. This would result in an allowable commercial harvest of 120,000 - 440,000 pinks, or if the 1971 run corresponds to the average estimated total return of 480,000, a commercial harvest of 280,000 pink salmon would be expected,

Alevin indices for the individual streams in the two districts indicate that the major areas of return will be Seldovia and Windy Bay.

FORECAST AREA: Southeastern Alaska

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1971 TOTAL RETURN:

Northern Southeastern	-	8.5 million
Southern Southeastern	-	<u>4.3 million</u>
Total Southeastern	-	12.8 million

FORECAST METHODS:

The forecast of 1970 pink salmon returns to Southeastern Alaska is based primarily on the results of sampling conducted at the pre-emergent fry stage. Data collected through 1970 has been used to establish relationships between observed pre-emergent fry abundance and subsequent adult returns. These relationships are used to forecast the 1971 pink salmon returns from the results of pre-emergent fry sampling conducted in the spring of 1970.

For the purpose of forecasting pink salmon returns, the Southeastern Alaska region is divided into a Southern district and a Northern district by a line extending through the Kuiu, Kupreanof, Mitkof Island complex. Tagging studies have indicated that the pink salmon of the Northern and Southern districts are separate stocks.

DISCUSSION OF 1971 FORECAST:

The 1971 forecast is not optimistic, being quite similar in magnitude to the parent year 1969 when the Southeastern pink salmon return totaled only 8.5 million. The predicted 1971 return to Southern Southeastern is 4.3 million pinks and to Northern Southeastern 8.5 million pinks. Combined this yields a total forecasted return of 12.8 million pink salmon for Southeastern Alaska. Thus the Southern district is expected to receive only one million more fish in 1971 than in the parent year 1969 while the Northern district is expected to receive only three million more.

Since 1967, odd-year pink salmon runs to Southeastern Alaska have been at relatively low levels but have reflected a gradual increase. If this increasing trend is to be maintained and the odd-year runs developed to maximum levels, it is imperative that adequate escape-ments be achieved in 1971. In the Southern district a desired escape-ment goal of 4-5 million dictates that little, if any, fishing can be allowed on this run - if the forecast is correct. In the Northern district

escapement requirements of 3-4 million fish indicate an expected harvest of approximately 5 million pink salmon from this run.

Prepared by: Louis Gwartney, Fishery Biologist  
Division of Commercial Fisheries  
Juneau

Contributing biologists: Kenneth Durley,  
Charles Larson, Gerry Downey

FORECAST AREA: Prince William Sound

SPECIES: Pink Salmon

PRELIMINARY FORECAST OF 1971 TOTAL RETURN:

Point Estimate = 6.2 million

Range Estimate = 5.0 - 7.4 million

FORECAST METHODS:

Pink salmon forecasts in Prince William Sound (total run, district strength and timing) are based on an alevin index and to date have been quite accurate in spite of the disrupting effect of the 1964 earthquake. The 1970 return of 3.7 million fell within the forecast range of 3.2-5.6 million.

DISCUSSION OF 1971 FORECAST:

The alevin index for the 1971 run is 282 pink alevins per square meter which is considered good and compares favorably with the alevin indices observed for the good runs of 1963 and 1969. A good return of 6.2 million fish is predicted for 1971. Assuming a total return of 6.2 million pink salmon as forecasted, the following predictions are also made:

Commercial Catch = 4.7 million (range = 3.5 - 5.9 million)

Catch for Peak Week = 1.7 million (range = 1.3 - 2.1 million)

Mean Catch Per Boat = 18,800 fish (range = 14,000 - 23,600 fish)  
(Based on 250 boats total effort.)

Areas not seriously affected by, or since effectively recovered from, the 1964 earthquake damage and able to withstand relatively intense fishing effort in 1971 are those areas lying within an arc extending westerly and southerly from Knowles Head to and including Latouche Island. Stocks which have fully recovered but which can withstand some harvest in 1971 are located in an arc easterly and southerly from Knowles Head to Cape Hinchinbrook. The majority of stocks originating on Montague Island have not yet recovered from the earthquake effects and should receive little, if any, fishing pressure in 1971.

If the 1971 run materializes as forecasted it is highly probable that it

will peak near the last week in July and all segments - early, middle and late - should be stronger than the parent year 1969. Coghill River should have a strong early run.

If the 1971 return materializes in the upper range of the forecast and a peak week catch of 1.7 million or greater is achieved, processing difficulties may occur.

SPECIES: Chum Salmon

PRELIMINARY FORECAST OF 1971 TOTAL RETURN:

Point Estimate = 760,000

Range Estimate = 600,000 - 920,000

FORECAST METHODS:

Chum salmon forecasts are based on the chum alevin index. The forecasting of chum salmon returns is complicated by the fact that, unlike pink salmon which always mature at two years of age, chum salmon may mature as three-, four- or five-year old fish. Quantitative information on factors affecting the maturing process is not available.

DISCUSSION OF 1971 FORECAST:

The chum forecast for 1971 is based on a relationship that exists between the alevin index and the subsequent return of four-year fish which is the major age class. The chum alevin density of 77 alevins per square meter observed for the parent year 1967 is the largest density observed since 1960 and is expected to contribute approximately 90 percent of the 1971 chum run as four-year fish. This density indicates a run of approximately 680,000 four-year chums in 1971 and a total (all age classes) 1971 chum run of approximately 760,000 (range 600,000-920,000) is expected.

Assuming a total chum run of 760,000, the commercial harvest of chum salmon is estimated to be 560,000. If the run materializes as forecasted, it is anticipated that the 1971 early and middle runs will be stronger than in recent years. Harvestable runs of chums

should appear by early July.

Prepared by: Robert S. Roys  
Chief Research Biologist  
Division of Commercial Fisheries  
Juneau

Contributing biologist: John D. Solf

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